I. Digital video basics

A. Applications

1. Film and video editing

    a) Digital only for authoring; delivery still done in an analog format. Constrained by analog playback limitations, but not by the performance of low-end playback computers.

    b) Avoids the time-consuming winding and rewinding of the video/filmstrip: "non-linear editing" (=instant access to any clip).

    c) If lossless or moderately lossy compression is used, there is no generation loss (unlike analog video editing).

    d) For absolute best quality, material may be acquired and re-recorded frame-by-frame.

2. Full-motion imagery for multimedia

    a) Image quality may be better than analog video because it does not have to conform to antiquated standards.

    b) Image quality may be worse than analog video because of limits to the storage capacity and data rate of the delivery medium. Material must play back in real time on widely available computers.

B. Compression

1. Used to reduce storage requirements and data rates. The latter can increase frame rate.

2. Codec (compressor-decompressor) choice determines technique used for compression.

    a) Symmetrical codecs compress about as fast as they decompress. The best playback comes from asymmetrical codecs (take substantially longer to compress): Cinepak, MPEG

    b) "Software" codecs (e.g., Cinepak) decompress fast enough to run on the general-purpose CPUs of personal computers

    c) "Hardware" codecs (e.g., MPEG) generally need special-purpose hardware for decompression, although as CPU speed increases the boundaries may shift (QuickTime 2.2 and ActiveVideo will suport MPEG-1 playback on PowerPC and Pentium CPUs).

3. Intraframe compression eliminates redundancy from within each frame. Same as compression technique used for still images. Best playback through lossy techniques.

4. Interframe compression eliminates parts of image that do not change from frame to frame

    a) Key frames are the ones to which no interframe compression is applied, and from which other frames are computed.

    b) With interframe compression, the movie plays backwards poorly. Random access to frames is limited or impeded (bad for video editing applications).

5. Highest compression generally used for delivery. Lower compression (lossless, intraframe only) used during editing to prevent generation losses and allow random access to all frames.

    a) Non-linear video editors use compression boards to accelerate recording and playback using higher-quality, slower codecs such as JPEG.

C. Hardware-independent playback

1. The main difference between animation formats (PICS, Director movies, HyperCard stacks used as flipbooks) and digital video formats (QuickTime, Video for Windows) is that the latter will "degrade gracefully" when played back on lesser hardware.

2. When the computer cannot keep up with the requested frame rate, QuickTime will try to maintain the same overall play time by skipping over some frames (frame dropping) until it is back on schedule. Video will be affected before audio, since audio drop outs will affect understanding of the material the most.

D. Optimizing QT for CD-ROMs

1. Use Premiere, MovieShop, Movie Cleaner (or MoviePlayer with QT 2.0) to throttle data rate.

2. Place files to be accessed sequentially in close physical proximity on the master disc.

3. Reduce quality: lower frame rate; downsample audio; decrease movie size; lower bit depth, increase compression.

E. Shooting video for multimedia
1. Less change from frame to frame = better interframe compression.
   a) Avoid extraneous subject and/or camera motions
   b) Strong lighting to minimize random image noise
      (1) When available, use pre-compression tools to filter out remaining noise
2. Less detail, areas of solid color, low contrast images = better intraframe compression.
   a) Evenly-lit uniform background; composite on clean background in post; use virtual sets.

II. QuickTime overview

A. Media types
1. Video, Audio, Music (MIDI), Text, Timecode, Sprites, 3DMF.
2. Different media handlers can play same media differently (e.g., PlainTalk speech from text track).
3. MoviePlayer will import files containing most supported data types and convert them to MooVs

B. Video codecs
1. None
   a) Any bit depth; Lossless; 2:1 compression or less; best for raw video captures (assuming storage device is fast enough)
2. Photo (= JPEG)
   a) 8 greyscale, 32 bits; Lossy/Lossless; 10:1 to 20:1 compression; best for photographic images
3. Animation
   a) 8 bits; Lossy/Lossless; 4:1 compression; best for computer generated animation
4. Graphic
   a) 1, 2, 4, 8 bits; Lossy; 11:1 compression; best for pre-dithered animation
5. Apple Video
   a) 16, 24 bits; Lossy; 5:1 to 8:1 compression; best for video
6. Cinepak
   a) 16, 24 bits; Lossy; 10:1 to 15:1 compression; best for video for CD-ROM
7. Component Video
   a) 24 bits; Lossless; 2:1 compression; best for raw video captures

C. Standard controller
1. Play/Pause
   a) Play/Pause button to the left of play bar.
   b) Double-click on image = play. Click = pause. Shift-double-click = play backward. Command-click single step buttons to play forwards or backwards. Space, Return = toggle play/pause.
   c) Control-click and hold on single step buttons to display tiny slider which can be dragged to play the movie at variable speed forward or backward.
   d) Hold down Option while using any method to start playback: forces display of every frame (no frame dropping).
2. Step
   a) Single-step buttons to the right of play bar.
   b) Left, Right arrow keys = single step.
   c) Option-click single step buttons to go to end or start of movie or selection (if any).
3. Volume
   a) Up, Down arrow keys = volume. Option-click on speaker icon = toggle sound mute.
   b) The volume knob in QuickTime's Movie Controller with Sound Manager 3.0 can overdrive the volume of a movie by Shift-dragging it, giving a boost to low signals.
4. Select

a) Shift-drag the play bar thumb = select section of movie. Shift-click on the play bar to select from the current frame to the location clicked.

b) Hold down the Shift key, and type Space or Return. The movie starts playing, selecting the played portion as it goes. When you release the Shift key, it stops playing and the played portion is selected.

5. Resize

a) Hold down Option while dragging the grow box for optimal sizing

D. MoviePlayer application

1. Pasting/Adding/Replacing

a) Pasting adds enough frames to the movie to hold the contents of the clipboard.

b) Hold down the Option key, then select the Edit menu: Paste becomes Add. This means what you paste in will occur simultaneously with what is selected in the movie.

c) Hold down Shift and Option: Paste becomes Add Scaled. Whatever you paste is scaled (sped up or slowed down) to take up the same amount of time as what is selected.

d) Hold down Shift: Paste becomes Replace. Clipboard contents replace the selection.

2. Clearing/Trimming

a) Hold down Option, select Edit menu: Clear becomes Trim. The portion of the movie which is *not* selected will be deleted.

3. Flattening/Storing in Data Fork

a) File-->Save As offers the option to save with dependencies or to flatten ("make self-contained") the movie. Movie-->Get Movie Info lists any dependencies.

(1) For self-contained movies, the checkbox "Playable on non-Apple computers" is available. If checked, all movie info will be stored in the data fork of the file.

4. Import/Export

a) Use the Import command in the File menu to convert various file formats to QuickTime movies

(1) After selecting the file to import, a Save dialog appears to allow naming the output movie. Click the Options button to set specific parameters

(a) For Midi files, choose instrument assignments for each channel

b) Use Export command in the File menu to convert individual media tracks to various file formats

(1) In the Save dialog use pop-up menu at the bottom to choose the media type and the file format. Click the Options button to set specific parameters

(a) For text files, you can export Descriptors (formatting info) and Time (start and end of each text segment) in addition to the actual characters.

5. Search text tracks

a) Use Edit-->Find to search for text occurrences in text tracks, even disabled ones

III. Digital video in Director

A. To allow control of a MooV using the standard controls, Cast-->Cast Member Info, check "Direct To Stage" and "Show Controller"

1. Direct to stage will provide optimal performance for MooV playback, but nothing can overlay the video, and custom inks cannot be used.

B. For best performance, no ink effects on Digital Video sprites, enable Preload Into RAM.

C. Exporting QT from Director

1. File-->Preferences to set stage to suitable size (W and H must be divisible by 16)

2. File-->Export. Frame Rate: Real Time = QuickTime MooV will play back at the same speed as Director movie on current machine; Tempo Settings = the Director tempo becomes the QuickTime MooV's frame rate (MooV may play faster than movie).

3. Linked sound files are not included and looped sounds do not loop in exported QT

D. Digital video sprite properties

1. movieTime; movieRate; startTime; stopTime; stopTime; volume

E. Digital video cast member properties
    1. center; controller; crop; directToStage; duration; frameRate; loop; pausedAtStart; preload; sound; video
F. Other relevant property
    1. preloadRAM